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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/530,322	04/05/2005	Atsushi Watanabe	US01-04071PCT	3070

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MCGINN INTELLECTUAL PROPERTY LAW GROUP, PLLC
8321 OLD COURTHOUSE ROAD
SUITE 200
VIENNA, VA 22182-3817

EXAMINER	
DURBIN, MICHAEL H	
ART UNIT	**PAPER NUMBER**
2815	

MAIL DATE	DELIVERY MODE
05/31/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/530,322	WATANABE ET AL.	
	Examiner	Art Unit	
	Michael Durbin	2815	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *30 April 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-6* is/are pending in the application.

4a) Of the above claim(s) *7 and 8* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *05 April 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *See Continuation Sheet*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Continuation of Attachment(s) 3). Information Disclosure Statement(s) (PTO/SB/08), Paper No(s)/Mail Date :04/05/05, 10/20/06, 12/01/06, 12/11/06 & 12/29/06.

DETAILED ACTION

Election/Restrictions

Applicant's election without traverse of Group I, claims 1-6, in the reply filed on 04/30/2007 is acknowledged.

Claims 7-8 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected invention, there being no allowable generic or linking claim.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. **Claims 1-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nagahama et al. (USPUB 2005/0121679 A1) (hereinafter Nagahama).**

Regarding claims 1-6: Nagahama discloses (embodiment 2, col. 18-col. 25) and shows (fig. 2) a group III nitride semiconductor light-emitting element, a GaN based LED, including an n-type contact layer of GaN doped with Si (12, col. 20, lines 22-24), and n-type clad layer of AlGaN doped with Si (14; col. 21, lines 18-23), and active layer (16), a p-type clad layer (19), and a p-type contact layer (20), comprising:

a crack-preventing layer (13) of n-type GaN-based materials provided between the n-type contact layer (12) and the n-type clad layer (14).

Nagahama does not explicitly disclose the limitation such as the use of a GaN crack prevention layer wherein the crack prevention layer has a dopant concentration lower than that of the n-type contact layer.

However, Nagahama teaches that the concentration of dopants in the contact layer may be in a range of $1x10^{17}$ /cm^3 to $1x10^{21}$ /cm^3, more preferably in a range of $1x10^{18}$ /cm^3 to $1x10^{19}$ /cm^3 (col. 20, lines 24-38). This range is established to keep down series resistance down as well as leakage currents. Further, Nagahama teaches that the n-type contact layer should have a dopant concentration greater than the n-type clad layer (col. 20, lines 33-38). It follows that the same should be true for the crack-preventing layer (13). Further, Nagahama discloses that the crack-preventing layer and the n-type clad layer each have the same dopant concentration of $5x10^{18}$ /cm^3 (col. 20, line 67 and col. 21, line 19). Thus, the contact layer would have, most preferably, a concentration above $5x10^{18}$ /cm^3 but below the upper limit $1x10^{19}$ /cm^3 for the lowest possible series resistance and leakage currents.

Still lacking from the disclosure of Nagahama is the limitation wherein the crack-preventing layer is formed of GaN.

Kano teach the use of a superlattice-type crack-preventing layer formed of both materials that compose the n-type contact layer and the n-type clad layer. In one

embodiment, layers of GaN and AlGaN are stack alternating in composition so that the crack-preventing layer is provided. This concept, when applied the GaN:Si (above $5x10^{18}$ /cm^3 but below the upper limit $1x10^{19}$ /cm^3) and AlGaN:Si ($5x10^{18}$ /cm^3) layers, the resulting crack prevention layer must have a concentration of dopants, when viewed as a single layer, equal to the average of the two given dopant levels. Thus the crack-preventing layer will have a lower dopant concentration level than the n-type contact layer. Further,

Kano is evidence that ordinary workers in the art would find a reason, suggestion, or motivation to use a crack-preventing layer with a superlattice.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the structure imparted by Nagahama by using a crack-preventing layer with a superlattice, since Kano teaches this improvement is more closely matches the two lattice constants (between GaN and AlGaN) than does a crack-preventing layer of InGaN (col. 1, lines 30-43).

As for claims 2, 3, and 4, Nagahama as modified by Kano teaches the use of a crack-preventing layer with a dopant concentration of $5x10^{18}$ /cm^3 and a n-type contact layer with a dopant concentration of above $5x10^{18}$ /cm^3 but below the upper limit $1x10^{19}$ /cm^3 (see rational above).

These claims are prima facie obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. In re Woodruff, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also In re Huang, 40 USPQ 2d 1685, 1688

(Fed Cir. 1996) (claimed ranges of a results effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also In re Boesch, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in a know process is ordinarily within the skill of art) and In re Aller, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art general conditions is obvious).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael Durbin whose telephone number is (571) 272-9766. The examiner can normally be reached on M-T 7:30-5; 1st Fri. of biweek off, 2nd 7:30-4.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ken Parker can be reached on (571) 272-2298. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Michael Durbin
Examiner
Art Unit 2815

MHD

Matthew C. Landau
Primary Examiner
5/26/07